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REMOTE DETECTION OF OH

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The details of the proposed JPL experiment to monitor [OH] are reasonably well summarized in the proceedings of the previous, 1982 H_xO_y Workshop (NASA Conference Publication 2332, p. 25, 1984).

This is a remote measurement technique utilizing a XeCl excimer laser tuned to the $Q_{21}1$ rotational transition of the 0—0, A—X band at 307.847 nm. A wavemeter is under development to monitor, on a pulse—to—pulse basis, both the laser lineshape and absolute wavelength (this should be operational by fall '85). Fluorescence is detected with a multiple Fabry—Perot type filter with a spectral resolution on the order of 0.001 nm. This is tuned to the overlapping $Q_2 2$, $Q_{12}2$, $Q_2 3$ and $Q_{12}3$ rotational transitions at 308.986 nm. The fringe pattern from this filter is imaged using a discrete, multi—anode detector which has a photon gain of 10^8. This permits the simultaneous monitoring of OH fluorescence, N_2 and/or O_2 rotational Raman scattering and broadband background levels. The use of three etalons in series provides sufficient rejection, $\geq 10^{10}$, against the laser radiation only 1.2 nm away.

Advantages of 308 nm excitation:

- higher absorption cross section
- less ozone absorption
- less artificial OH generation
- simpler relaxation kinetics
- efficient, high power, tunable transmitter available

Advantages of FP multispectral detector

- simultaneous measurement of fluorescence, background and normalization intensities — requires only one laser and one wavelength
- greatly reduced solar, and other broadband, background

In summary, the 308 nm scheme would yield an increased fluorescence signal and a reduction in the level of interference, by many orders of magnitude compared to the measurements reported to date. The technique provides a realistic sensitivity at the $[OH] = 10^5$ molecule cm^{-3} level.

Comments

The 308-nm excitation scheme presented by the JPL researchers seemed reasonably possible of achieving the required sensitivity. However, the triple etalon, with a 10^{14} contrast ratio at a bandpass of 0.001 nm, seemed very risky to most of the workshop participants. Measurements on and off line can be used in conjunction with rotational Raman to yield multiple species measurements. The projected high sensitivity with short integration times suggests a more detailed examination of the scheme would be valuable, although satisfactory manufacture of the etalon seemed itself to be a major technological achievement. Concern was expressed over off-axis solar radiation and the level of interference it would cause.

In order to reduce lidar data to absolute concentrations, independently determined collisional cross sections are needed. For this narrowband work, this includes rotational transfer and quenching on a state-specific basis. This contrasts with the sampling systems where calibrations can be used. However, it was felt that high accuracy was here not an important issue; high-precision measurements were of value and ultimately the accuracy could be determined. A pooling of the knowledge of those people experienced with such etalons should be brought together in an experiment demonstrating the high rejection of both on-axis and off-axis light.